tube A is narrowed in the middle, and its lower extremity terminates in a narrow tube about 33 inches long, and dipping into a cylinder of mercury. Some boiled water was introduced into A before the thermometer was attached, and a small quantity of water was placed in the copper flask. The air was then removed by the Sprengel, the exhaustion being facilitated by heating the copper flask. The water in the glass tube was also heated, in order to expel the dissolved air. When the exhaustion had been completed, the cylinder of mercury was raised until the mercury in the tube stood at the narrow part of A, and the cylinder surrounding the tube was filled with a freezing mixture of ice and salt, the copper flask being also placed in a similar mixture. When the water in the glass tube was solidified, the freezing mixture was removed from the cylinder, the latter lowered, and the column of mercury was depressed by lowering the cylinder of mercury until the column stood at the bottom of A.

A small gas flame was employed to warm the part of the tube containing the ice; some of the ice at the lower part of the solid plug melted and ran down to the surface of the mercury; the upper portion of the ice could not be fused in consequence of the diminished pressure on its surface. When the ice was completely detached from the glass tube a fresh quantity of freezing mixture was placed in the cylinder surrounding the lower part of A.

The air of the room was at 15° C., and the thermometer in the ice indicated – 8°. The tube A was now heated by a Bunsen burner, and the temperature shown by the thermometer was – 6°·5. A jet of steam from a test-tube with cork and narrow tube was directed against the side of A until the ice became very thin on one side of the thermometer bulb; the temperature was now – 1°. The freezing mixture surrounding the copper flask was nearly exhausted; it was therefore replaced by fresh ice and salt, and the steam once more directed against the tube. The thermometer now read – 5°·2. When a small part of the thermometer bulb was free from ice the jet of steam was stopped, and a new freezing mixture placed round the flask, the thermometer indicating – 6°·7. When about one-third of the bulb was exposed the tube was heated by a Bunsen flame and the temperature rose to + 4°, and on allowing the tube to cool it fell to – 5°. Finally, when only a very narrow strip of ice remained attached to one side of the bulb, the tube was strongly heated, and the temperature rose to + 12°, but on cooling it sank to – 2°·2.

The experiment was repeated on January 6, a jacket being placed round the tube so that the heating by steam was more regular than before. On first separating the ice from the containing tube the thermometer indicated – 8°. On heating with a Bunsen it rose to – 6°. When the tube was cold the temperature was – 14°. After passing a current of steam round the tube for half an hour the temperature was – 11°. A fresh freezing mixture was now used, and the steam again turned on; after twenty minutes a small portion of the thermometer bulb became exposed, and two minutes later the temperature was – 9°. A fresh freezing mixture was put round the flask, and when the outside of the tube was cold, the thermometer showed a temperature of – 16°. Steam was again turned on for fifteen minutes, when the temperature was – 12°. When the bulb was half exposed the steam jacket was removed, and the tube heated by a Bunsen; the temperature then rose to – 1°·5. On allowing it to cool it fell again to – 12°. When about three-quarters of the bulb was free from ice the tube was again heated by the gas flame, and the temperature rose to + 29°. The ice then fell off, and although the heating was discontinued the thermometer rose rapidly to 70°.

These experiments, as far as they go, are therefore in accordance with those of Mr. Hannay and Prof. Lothar Meyer, there being no considerable rise of temperature until either the condensation of the aqueous vapour was too slow and the vacuum thus deteriorated, or the thermometer bulb was partly uncovered, and so exposed to direct radiation from the walls of the outside tube.

Two experiments were tried with mercuric chloride, but the results were not satisfactory, in consequence of the high melting point of the solid. The temperature seemed to be above the fusing point, but it was found that the mercury in the thermometer stem had separated. HERBERT MCLEOD

Cooper's Hill, May 3

Sound of the Aurora

UNDER the above heading Mr. Ogle, in last week's NATURE (vol. xxiv. p. 5), gives an extract from the Visitors' Book at the Æggischorn Hotel describing certain electrical effects which were experienced by Mr. and Mrs. Spence Watson, Mr. Sowerby, and myself on July 10, 1863. I would add one or two facts with regard to our position and experiences. We reached the top of the Jungfrau Joch at 10.5 a.m., and were met by a violent hailstorm, which came rolling up from the northern side of the Col. We at once started to return, and had been walking for two hours down the centre of the Aletsch glacier when the electrical effects began to be felt; we reached the Mërjelen See at 3.15, so that at the time of the occurrence we had reached the lower part of the *névé* which is farthest from surrounding mountain tops, where the glacier is widest. We were enveloped in cloud, above which there were no doubt other clouds charged with electricity, and as they approached we were gradually being charged more and more strongly by induction from the lower cloud, and when the discharges or thunder occurred we were suddenly relieved by an electric shock. A kind of *brush discharge* of gradually increasing intensity went on for some minutes, followed by a sudden shock, and this process of bringing us up to the right state of excitement, to be relieved by a sudden shock, was repeated over and over again several times.

The hissing sounds were first heard in the alpenstocks, and gradually increased in loudness up to the sudden discharge. There were clear indications that as condensers of electricity we were not all of the same capacity. We were roped together in threes: in one set of three I was in the middle, with a guide in front and Mr. Sowerby behind. Whilst the charging was going on I felt the pricking sensation at the waist on the side where the cord was knotted, showing that those who were more influenced by electrical induction were charging the others through the rope which acted as a conductor. Judging by his actions, our guide (a young and active man) was strongly influenced by the charge, whilst Mr. Sowerby, the most staid and venerable of the party, was certainly influenced the least. In the other set of three the elderly J. M. Claret of Chamouni was least affected, whereas Mr. Watson, who was not the youngest of the party, was the most powerfully affected. These facts point to a direct relation between the temperament of the individual and his capacity for being excited electrically or his inductive capacity.

I should add that Mr. Packe has had similar experiences, but apparently to a less extent, in his walks in the Pyrenees.

W. GRYLLS ADAMS

Wheatstone Laboratory, King's College, May 9

Palæolithic Man

IN my communication to NATURE, vol. xxiii. p. 604, I chiefly restricted my notes to the higher gravels on the north side of the Thames in and near London. With your permission I will now briefly refer to some of the implementiferous gravels south of London, especially in Kent.

The best known of these are to be seen between the Reculvers and Herne Bay, where a thin stratum of implementiferous gravel caps the cliffs. Similar but deeper gravels, also bearing implements, occurs elsewhere inland, as at and near Chislet. At Canterbury a great number of implements have been found, and to these gravels and implements I would now direct attention. As a rule the Reculver instruments are sharp, unstained, and unabraded (such as have been rolled in the sea of course excepted); the Canterbury examples where the gravel is deep are found at various depths, from 9 feet to 20 feet.

Now there are two distinct classes of implements found in the Canterbury pits, the levels being, according to Dr. Evans, about 80 feet or 100 feet above the river: in one class the specimens are well made and almost as sharp and unstained as when first turned from the maker's hands, in the other the implements are much more rudely made, deeply stained all over of a dark ochreous brown colour, and abraded in a high degree. These latter implements come from distinct strata or deposits of ochreous brown rolled stones that appear to have been brought from a long distance. In my own collection of twenty-nine examples from Canterbury one half are sharp and bright, the other half greatly rolled and deep brown in colour. To my mind these two classes of instruments represent two totally distinct periods in the Palæolithic age immensely removed in time from each other, the abraded examples being the oldest. A point of importance to be observed in the deeply ochreous implements is that many of them were slightly splintered or broken when they were deposited in the Canterbury drift; now these broken and

© 1881 Nature Publishing Group

splintered parts are bright, lustrous, and non-ochreous, exactly resembling in the fractured parts the bright and unabraded implements. This fact appears to me to demonstrate that the abraded ochreous implements acquired their ochreous crust elsewhere, and were objects of great antiquity when the Canterbury gravels were laid down. I have one of these deep-brown greatly-rolled flint implements that was found amongst chert in the famous pit at Broom, near Exeter: the deep ochreous colour was not derived from chert gravel. From whence have these generally massive, abraded, ochreous implements been derived, and how laid down in distinct deposits?

As an instance of very high implementiferous gravels, the same distance south of London as the Ware gravels are north, the ancient gravels on the escarpment of the hills north of Sevenoaks and Ightham may be cited. Some of these heights exceed by 200 feet the heights of the Hertford and Ware positions.

Dr. John Evans, in his admirable book on the "Ancient Stone Implements of Great Britain," pp. 531-532, records the important discovery (on the surface) of ochreous and abraded implements at great heights near Currie Wood, a few miles south of St. Mary's Cray, Kent, at 300 feet above the valley of the Darent, and 500 feet above the sea. Dr. Evans also says (p. 531), "It is, however, necessary that further discoveries should be made in this district before it will be safe to speculate on the origin of these gravels and their relation to the superficial configuration of the neighbourhood." My friend, Mr. Benjamin Harrison of Ightham, has during the last year instituted a rigorous search over the high level gravels south of this district. A tributary of the Medway rises at Ightham, near Sevenoaks; the level of the present stream near the village is 254 feet, and an outlying bed of old river-gravel is found at 330 feet, and another bed up the stream at an altitude of from 380 feet to 400 feet. In these high-level Wealden gravels Mr. Harrison has recently found palæolithic implements *in great numbers*, generally massive, ochreous, and abraded. At 312 feet he has found them *in situ*, and on the surface as high as 335 feet. More recently Mr. Benjamin Harrison has examined the old river gravel at Dunk's Green (two miles and a half south of Ightham), and here at a level of 200 feet has proved the beds to be implementiferous. For these facts and heights I am indebted to Mr. Harrison, who has given me his permission for their publication.

In these two letters I have chiefly confined myself to statements of dry facts, purposely abstaining from any comments on the meaning of the heights, &c., referred to.

WORTHINGTON G. SMITH

125, Grosvenor Road, Highbury, N.

Naval Cadet Examinations

I WISH to bring to your notice the injudicious severity to which our competitive examinations have of late attained, regardless, as it appears to me, of the possible injury they may inflict on the health of those who are forced to strain every power, both physical and mental, in the struggle.

The most recent example of the kind is, I believe, the New Standard for Naval Cadetships, which requires boys from between the ages of twelve and thirteen and a half to pass a competitive examination in Latin, French (both translating and speaking), arithmetic up to decimal fractions, algebra, including fractions and simple equations with one unknown quantity, geometry up to first twenty-six propositions of Euclid, English—with Scripture history. They are further tempted, if ambitious, to take algebra up to quadratic equations, and geometry up to the end of the first book of Euclid.

Now when the object to be obtained is no less than a career for life, one can imagine what a force of pressure—from the parent anxious to provide for his son, from the schoolmaster's pride in his pupil, and from the boy's own ambition—is brought to bear to urge nature to the utmost in the trial.

The casualties—for we are entitled to use the expression—that have already occurred under the system have been sufficiently numerous to make any one who will pause to think seriously anxious.

Education is most valuable, but when its attainment is at any time carried out at the expense of health to the pupil it is a failure. "Mens sana in corpore sano" is above everything to be prized, and he who enters upon life's work possessed of that advantage is fittest for its trials.

I will quote an extract from the *Lancet*, which treats the subject from a professional point of view and with an admirable clearness. It says:—

"There can be no room to question the extreme peril of 'over-work' to growing children and youths with *undeveloped* brains. The excessive use of an immature organ arrests its development by diverting the energy which should be appropriated to its growth, and consuming it in work. What happens to horses which are allowed to run races too early happens to boys and girls who are over-worked at school. The competitive system as applied to youths has produced a most ruinous effect on the mental constitution which this generation has to hand down to the next, and particularly the next-but-one ensuing. School-work should be purely and exclusively directed to development. "Cramming" the young for examination purposes is like compelling an infant in arms to sit up before the muscles of its back are strong enough to support it in the upright position, or to sustain the weight of its body on its legs by standing while as yet the limbs are unable to bear the burden imposed on them. A crooked spine or weak or contorted legs is the inevitable penalty of such folly. Another blunder is committed when one of the organs of the body—to wit, the brain—is worked at the expense of other parts of the organism, in face of the fact that the measure of general health is proportioned to the integrity of development and the functional activity of the body as a whole in the harmony of its component systems. No one organ can be developed at the expense of the rest without a corresponding weakening of the whole. These faults of 'training' attain their supreme height of folly and short-sightedness when they are committed in reference to the youths destined for the public services. They are especially illustrated by the 'Regulations respecting Naval Cadets' just issued, and which will take effect in June of the present year. The work of the Civil Service Commissioners in respect to these classes of the possible servants of the State is personally and racially *destructive*. Sooner or later public opinion must recognise this fact, and then perhaps the Government or the Legislature may be moved to interpose—not before, but when it is too late."

We live in an age of reactions, when ideas are hastily adopted, hurriedly brought into practice, and fanatically adhered to. I can only hope that public opinion will recognise the danger that the *Lancet* so clearly points out, and that the Government may interpose before it be "too late."

J. D.

Flame-Length of Coal-Gas

I HAVE recently measured the flame-length of a sample of coal-gas burning in air and burning in nitrous oxide (N_2O). The flame-length in air was $\frac{13}{10}$ths of an inch and $\frac{5}{10}$ths in nitrous oxide. The relation of 5 to 13 is very close to what my theory would suggest, and is a confirmation of my law published in your issue of April 7.

I might add that I have recently noticed the flame of a mixture of hydrogen and nitrous oxide burning in air to develop a bright white spot about one-third from the top of the flame, and when the proportion of nitrous oxide is larger, to extend into a cone reaching to the jet. I have not examined this flame with a spectroscope, but am certain, from the whiteness of the flame, that the spectrum would be continuous.

LEWIS T. WRIGHT

Water in Australia

A GENTLEMAN recently returned from Australia believes that the arid plain which occupies the centre of that island-continent might be amply supplied with water and converted into rich farm land by a very simple process. He founds his belief upon observed facts in the three sciences of botany, physiography, and geology, thus:—

1. Gum-trees and the mallee scrub flourish there. The gum-trees grow to a great size and withstand the drought of many summers. They must have water; whence do they obtain it?
2. Rivers which flow towards the centre from the mountain ranges along the coasts have no apparent outlet into the sea, but are lost in the desert. What becomes of them?
3. The underlying rock of the central plain is an almost horizontal bed of Tertiary Sandstone.

The conclusion is that the Sandstone is saturated with water and forms an immense reservoir from which existing trees draw their supplies by deep tap-roots, and that by sinking wells in the desert this water could easily be reached.

The author of this theory, wishing only to confer a public benefit, desires to bring it under the notice of scientific men,

© 1881 Nature Publishing Group